**IN THE SPECIFICATION:**

Please amend the paragraph beginning at page 1, line 24 as follows:

A simplified diagram of a conventional exposure tool is shown in FIG. 1. As can be seen, light source 100 projects light waves 108 through opening 102 in aperture stop 101. Opening 102 is commonly referred to as the pupil of the aperture stop. Condenser lens 105 collects the light from the opening 102 and focuses it on mask 106 such that the mask 106 is evenly illuminated. When illuminating beam 103 passes through mask 106, imaging beam 109 is generated. Imaging beam 109 is projected through projection lens 107 such that the image of the pattern on the mask 106 is focused onto the silicon wafer 110. As can be seen in FIG. 1, the opening 102 is situated in the center of aperture stop 101. Because of this, illuminating beam 103 is projected along the optical axis (dashed line 104) from the opening 102 to condenser lens 105 and mask 106. This type of illumination method is called "On-axis illumination,"- the name implying that the illumination beam is "on" the optical axis.

Please amend the paragraph beginning at page 2, line 8 as follows:

One important limiting characteristic of any exposure tool is its resolution limit. The resolution limit for an exposure tool is defined as the minimum feature that the exposure tool can repeatedly expose onto the wafer, which is close to the smallest dimension (referred to as the critical dimension or CD) for many current IC layer ~~design~~ designs.

Please amend the paragraph beginning at page 2, line 23 as follows:

The resolution (R) and the DOF of an exposure tool are proportional to the exposure wavelength ($\lambda$) and are inversely proportional to the numerical aperture ($NA_{lens}$) of a projection optical system of the exposure tool, as shown in the following equations (1) and (2):

Please amend the paragraph beginning at page 3, line 13 as follows:

Referring to FIG. 1, for the conventional photolithography process, the wafer 110 having a photoresist layer formed thereon is exposed with one fixed illumination setting ~~involved~~ involving numerical aperture ($NA_{lens}$), sigma value ($\sigma$) and exposure energy to generate enough photo-acid for target critical dimensions (CDs).

Please amend the paragraph beginning at page 4, line 21 as follows:

A conventional photolithography process with double exposures using two masks is employed to overcome the above problems. However, ~~it causes~~ this process creates another issue~~,~~ regarding the alignment accuracy of the two masks. The throughput of the photolithography process is also decreased.

Please amend the paragraph beginning at page 4, line 26 as follows:

Since the conventional photolithography process with its single exposure method using single illuminating setting cannot fulfill the optimum illuminating setting for patterns at all pitches, an improved photolithography process using multiple exposures with matching illuminating settings is ~~developed~~ needed.

Please amend the paragraph beginning at page 5, line 16 as follows:

It is a further objective of the present invention to provide a photolithography process with multiple exposures, which is suitable for different wavelengths, including ~~of~~ I-line, deep ultraviolet ray, extreme ultraviolet ray, X-ray and ion projection lithography (IPL) etc.

Please amend the paragraph beginning at page 5, line 21 as follows:

In order to achieve the above objectives, the present invention provides a photolithography process with multiple exposures. A photomask is placed and aligned above a wafer having a photoresist formed thereon at a predetermined distance. Multiple exposures are sequentially performed on the photoresist through the photomask. Each of the multiple exposures is provided with a respective illuminating setting that is optimized for one of the duty ratios of the photomask. Thereby, an optimum through-pitch performance for pattern transfer from the photomask unto the photoresist is obtained. Then, a development is performed on the photoresist.

Please amend the paragraph beginning at page 6, line 3 as follows:

The above and other objectives, features and advantages of the present invention will be apparent from the following description with reference to the accompanying drawings:

Please amend the paragraph beginning at page 6, line 30 as follows:

The present invention provides a photolithography process with multiple exposures through a single photomask to pattern a photoresist layer formed on a wafer. Each of the multiple exposures is provided with a respective illuminating setting including illuminating parameters of numerical aperture (NA), sigma value ($\sigma$), exposure energy, focus position and pupil type of an exposure tool utilized in the multiple exposures. Herein, the numerical aperture (NA) is referred to as the numerical aperture of a projection optical system of the exposure tool, and the sigma value is referred to as the sigma value of an illuminating optical system of the exposure tool. All the illuminating parameters can be obtained by adjusting the settings of the exposure tool. ~~Please note,~~ It should be noted that each of the multiple exposures is performed with a respective illuminating setting that is optimized for a specific duty ratio, a ratio of pitch to critical dimension (CD), of the photomask. Accordingly, the present invention can combine the respective pattern transfers of the multiple exposures to obtain a good through-pitch pattern transfer performance.

Please amend the paragraph beginning at page 7, line 15 as follows:

FIG. 3 shows a flow chart of a photolithography process with multiple exposures according to the present invention. In step 31, a photoresist is firstly formed on a wafer. The method of forming the photoresist includes spin coating. A photomask is then disposed and aligned over the wafer at a proper distance. The photomask has a pattern that is replicated into the photoresist. The pattern has a set of specific duty ratios, i.e., a set of ratios of pitch to critical dimension (CD).

Please amend the paragraph beginning at page 7, line 23 as follows:

Next, in step 32, multiple exposures including a first exposure to nth exposure are sequentially performed through the photomask on the wafer having the photoresist formed thereon. The times of the exposure step are determined in accordance with the set of duty ratios of the photomask. A first exposure is performed with a first illuminating setting that is optimized for one of the duty ratios of the photomask by adjusting the setting of the exposure tool. A second exposure is next performed with a second illuminating setting that is optimized for another duty ratio of the photomask. The exposure step is repeatedly performed with different illuminating ~~setting~~ settings until all of the duty ratios of the photomask are fulfilled. A resulting pattern transfer combining all the respective pattern transfers of the multiple exposures is thus obtained. Since each exposure step is provided with a specific illuminating setting optimized for one duty ratio of the photomask, a good through-pitch performance for pattern transfer is obtained by the present invention.

Please amend the paragraph beginning at page 8, line 12 as follows:

It should be noted that the multiple exposures of the present invention are suitable for different wavelengths, including ~~of~~ I-line, deep ultraviolet ray, extreme ultraviolet ray, X-ray and ion projection lithography (IPL) etc.

Please amend the paragraph beginning at page 8, line 17 as follows:

As described in the technical background, if the range of DOF of an exposure tool can be extended, the usable resolution limit of the exposure tool may be decreased and smaller images may be printed on the photoresist. Additionally, the DOF of an exposure tool for a dense pattern (the duty ratio is small) is extended as the sigma value ($\sigma$) of the exposure tool is increased~~. While,~~ while the DOF of the exposure tool for an isolated pattern (the duty ratio is large) becomes shallower.

Please amend the paragraph beginning at page 8, line 25 as follows:

In a first embodiment of the present invention, a first exposure with a high sigma value ($\sigma$) about 0.85 and a numerical aperture about 0.68, which is better for a dense pattern transfer, is performed on the photoresist through a photomask having a dense pattern and an isolated pattern formed therein. A second exposure with a low sigma of about 0.35 and a numerical aperture of about 0.68, which is better for the isolated pattern transfer, is then performed on the photoresist through the photomask. A resulting pattern transfer combining the respective pattern transfers of the first exposure and the second exposure is thus obtained. FIG. 4A shows a combination effect of the first exposure and the second exposure of the first embodiment, which is a diagram of critical dimension (CD) vs. focus of an exposure tool utilized in these two exposure steps. It is apparent that the DOF of the exposure tool is extended, ~~comparing~~ compared with the conventional photolithography process with a single illuminating setting.

Please amend the paragraph beginning at page 9, line 12 as follows:

An alternative way to reduce the usable resolution of an exposure tool by extending its associated DOF range is to employ an off-axis illumination (OAI) technique. The off-axis illumination projects an illuminating beam at an angle other than that of the optical axis, the DOF of the exposure tool thus can be extended. The off-axis illumination type can be a quadruple type illumination, an annular type illumination, a dipole type illumination, etc. However, the off-axis illumination significantly increases the DOF range of the exposure tool for the dense pattern but provides little DOF improvement for the isolated pattern. In a second embodiment of the present invention, the advantages of off-axis illumination for the dense pattern and low sigma value for the isolated pattern are combined.

Please amend the paragraph beginning at page 9, line 25 as follows:

In the second embodiment of the present invention, a first exposure with off-axis illumination and a numerical aperture <u>of</u> about 0.68, which is better for a dense pattern transfer, is performed on the photoresist through a photomask having a dense pattern and an isolated pattern formed therein. The off-axis illumination type can be selected by changing a pupil type of an illuminating optical system of an exposure tool utilized in the second embodiment. A second exposure with a low sigma value <u>of</u> about 0.35 and a numerical aperture <u>of</u> about 0.64, which is better for the isolated pattern transfer, is then performed on the photoresist through the photomask. A resulting pattern transfer combining the respective pattern transfers of the first exposure and the second exposure is thus obtained. FIG. 4B shows a combination effect of the first exposure

and the second exposure of the second embodiment, which is a diagram of critical dimension (CD) vs. focus of an exposure tool utilized in these two exposure steps. As shown in FIG. 4B, the DOF of an exposure tool is significantly extended, compared with the conventional photolithography process with a single illuminating setting.

Please amend the paragraph beginning at page 10, line 24 as follows:

The embodiments are only used to illustrate the present invention, and are not intended to limit the scope thereof. Many modifications of the embodiments can be made without departing from the spirit of the present invention.